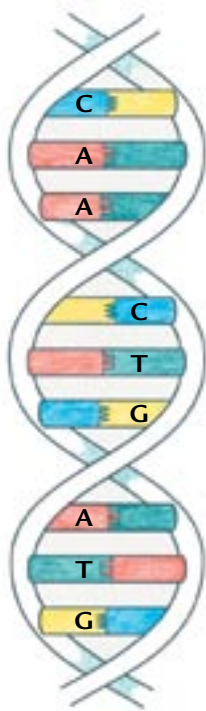


# 69 Evidence from DNA



*DNA is double-stranded. One strand provides the information in the gene. Both strands are needed when the gene is copied.*

**B**lood type results show that some of the lost children *might* be Belinda and John's or Mai and Paul's, but how can the investigators know for sure? DNA typing can be used to check for exact DNA matches. This is sometimes called **DNA fingerprinting** because it gives a unique result that helps identify people, but it is actually very different from regular fingerprinting. Since DNA fingerprints of relatives are much more alike than those of unrelated people, they can be used to find out if people are related.

Each person, except for identical twins, has unique genetic information. This information is encoded in long molecules of DNA in the chromosomes. DNA can be extracted from cells, cut into pieces, sorted, and stained. The pattern of these DNA fragments looks almost like a complicated bar code. DNA fingerprinting reveals your own unique pattern, which is almost as unique as your DNA itself.

The genetic code is made up of four "letters" (A, T, C, and G), each of which stands for one of four related chemicals that are strung together in the DNA. The order of these letters provides information. Since the sequences of the genes do not vary much among people, fingerprinting genes would not easily give information that could be used to tell people apart. (Two different alleles of the same gene might vary in only 1 of hundreds of letters.) However, long regions of DNA between the genes vary a lot more among people and can be used to tell people apart. That is why we "fingerprint" these regions between the genes.



**What makes your DNA fingerprint unique?**

## MATERIALS



For each group of four students

- 1 roll of clear tape or glue



For each pair of students

- 1 Student Sheet 69.2, "DNA—Person 1"
- 1 Student Sheet 69.3, "DNA—Person 2"
- 2 pairs of scissors



For each student

- 1 Student Sheet 69.1, "KWL: DNA and DNA Fingerprints"
- 1 Student Sheet 69.4, "A DNA Fingerprint"

## PROCEDURE

Use Student Sheet 69.1, "KWL: DNA and DNA Fingerprints," to guide you as you complete the following activity.

### Part A: How are DNA fingerprints used?

1. Compare the DNA fingerprints in the illustration. Blood found on a broken window pane at the scene of a burglary provided the first fingerprint. The other two fingerprints are from two suspects. In your science notebook, record your conclusion about whose blood was on the window.

Blood at crime scene



Suspect 1



Suspect 2



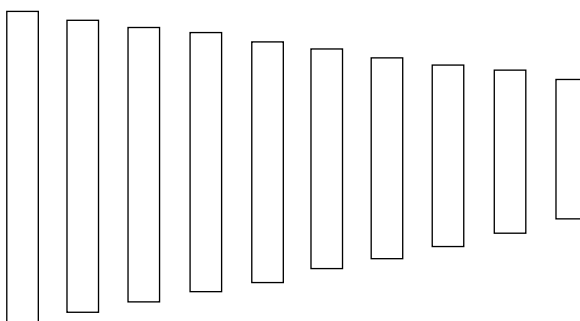
Different lengths of DNA are in different positions on the “fingerprint.” That’s because the fragments of a person’s DNA are sorted by length. Note that some of the bands are darker than others. Pieces that are the same length are piled in one spot. Therefore, the dark bands represent the more common lengths of DNA in each person.

### Part B: Why is every person’s DNA fingerprint so different?

2. Take one of the Student Sheets showing DNA sequences and give the other to your partner. Keep the Person 1 DNA separate from the Person 2 DNA.
3. Assemble the DNA strand: Cut out the strips of DNA. Tape them together in order, forming a single long strand. (Real DNA extracted from cells has several billions of these letters—and they’re already strung together!)
4. Hold the DNA from Person 1 above the DNA from Person 2. Compare the DNA sequences, looking for similarities and differences. Record your observations in your science notebook.
5. Cut the DNA strand by making cuts only AFTER the sequence of letters AAG. For example, the following sequence would be cut like this:

A A T G C T A G T T C G G T G A T A A G ✂ C G G T G T T T A G G C T T A G

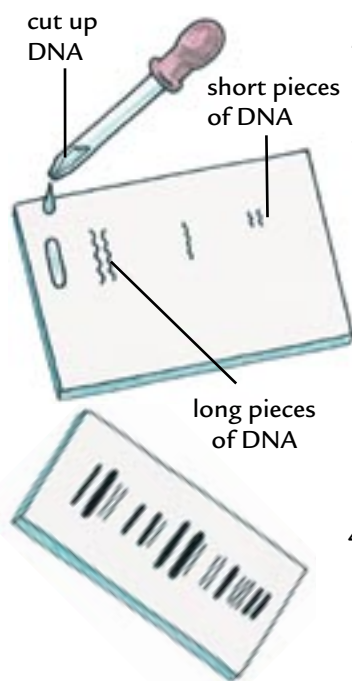
6. Sort your DNA pieces, with the longest piece at the left end of Student Sheet 69.4, “A DNA Fingerprint,” and the shortest piece at the right end. See the example below.



7. Tape or glue your DNA pieces onto Student Sheet 69.4, “A DNA Fingerprint.”
8. Compare your DNA fingerprint to one prepared by another student who had the same person as you did. Do the DNA fingerprints match? Should they?
9. Read “How DNA Fingerprinting Is Performed in the Lab” on next page.

## How DNA Fingerprinting Is Performed in the Lab

1. Technicians put the cell sample into a tiny test tube. They break open the cells and use chemicals to extract, or take out, the DNA.
2. The DNA is cut into pieces with special chemicals called enzymes.
3. The pieces of DNA are separated based on their length:
  - The pieces are put into a hole in a flat, rectangular agar gel.
  - The technician then runs an electrical current across the gel, which makes the pieces of DNA move toward the positive end.
  - The smaller pieces of DNA move faster than the bigger pieces.
4. Special techniques are used to make the bands of differently sized DNA visible.



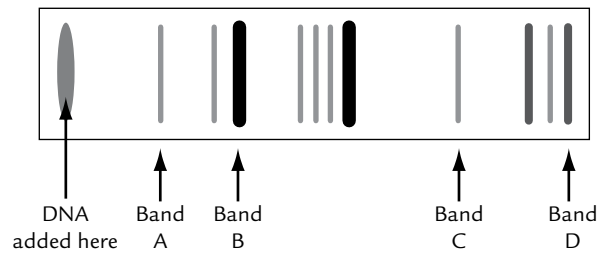
## ANALYSIS



1. In your science notebook, create a table like the one below. In the table, match the steps you did in the simulation to the steps scientists use to make DNA fingerprints.

	What scientists do	What we did in the simulation
	Extract DNA from cells	
	Cut the DNA with enzymes	
	Use an agar gel and electric current to separate DNA pieces	
	Make the DNA visible	

2. Look at this DNA fingerprint.



- a. Which single band represents the smallest pieces of DNA? Explain how you can tell.
  - b. Which single band represents the most common length of DNA for this fingerprint? Explain how you can tell.
3. Why are DNA fingerprints unique to each person? In your explanation, refer to the way that DNA is cut up and sorted, and refer to the DNA of Person 1 and Person 2 from the activity.



## EXTENSION

Go to the *Issues and Life Science* page of the SEPUP website for links to websites about the Human Genome Project. Here you can explore some of the latest research on human genes.